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Solution by V. M. SPUNAR, C. E., Chicago, Ill.

If the cells in the mth row are connected in series, the current in that row is, by Ohm's law,

$$C_m=\frac{mE}{mr+R_m},$$

where R_m is the external resistance$=2r(n-m+1)$, by the conditions of the problem. Hence, the total current is

$$C=\sum_{m=1}^{m=n}\frac{mE}{mr+2r(n-m+1)+2r}=\frac{E}{r}\sum_{m=1}^{m=n}\frac{m}{2(n+2)-m}$$

$$=\frac{E}{r}\sum_{m=1}^{m=n}\left[-1+\frac{2(n+2)}{2(n+2)-m}\right]=\frac{E}{r}\left[-n+2(n+2)\sum_{m=1}^{m=n}\frac{1}{2(n+2)-m}\right]$$

$$=\frac{E}{r}\left[2(n+2)\left(\frac{1}{2n+3}+\frac{1}{2n+2}+\frac{1}{2n+1}+\ldots+\frac{1}{n+4}\right)-n\right]$$

$$=\frac{E}{r}\left[2(n+2)\,(S_{2n+3}-S_{n+3})-n\right],\quad\text{where } S_p=\tfrac{1}{1}+\tfrac{1}{2}+\tfrac{1}{3}+\ldots+\frac{1}{p}.$$

But $S_{2n+3}-S_{n+3}=\log(2n+3)-\log(n+3)$

$$+\frac{1}{2(2n+3)}-\frac{1}{2(n+3)}-\frac{1}{12(2n+3)^2}+\frac{1}{12(n+3)^2}\ldots,$$

(see MONTHLY, Vol. XVI, p. 166)

$$=\log\left(\frac{2n+3}{n+3}\right)+\tfrac{1}{2}\cdot\frac{n}{(n+3)\,(2n+3)}+\tfrac{1}{4}\cdot\frac{n(n+2)}{(n+3)^2\,(2n+3)^2}+\ldots$$

When $n\doteq\infty$, $S_{2n+3}-S_{n+3}\doteq\log 2$.

NOTE. Contributors are asked to send in solutions of problems 255, 256, 257, 258, and 259. 255 is on page 247, Vol. XVII.

AVERAGE AND PROBABILITY.

203. Proposed by J. EDWARD SANDERS, Weather Bureau, Columbus, Ohio.

Find the average length of a hole at random through a cone.

No solution of this problem has been received.